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EXPLORATORY SYSTEMS CONTROL MODEL DEVELOPMENT (ESMD) USER MANUA--ETC(U)
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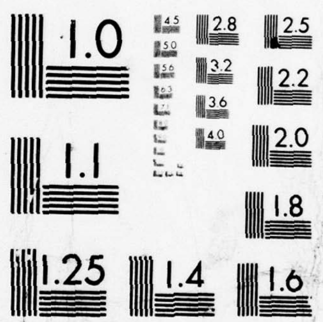

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March 1978

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USER MANUAL

EXPLORATORY SYSTEMS CONTROL MODEL DEVELOPMENT (ESMD)

FOR

THE DEFENSE COMMUNICATIONS AGENCY
WASHINGTON, D.C. 20305

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FOREWORD

This publication is the User Manual for the Exploratory Systems Control Model Development (ESMD). It describes the system, each capability and how to use it. This manual was prepared by the Burroughs Corporation and is submitted in accordance with the requirements of contract DCA100-76-C-0081.

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SECTION 1
INTRODUCTION

1.1 PURPOSE

The Exploratory Systems Control Model (ESM) consists of the original three loop ESM network delivered under Contract DCA100-75-C-0054 and the fourth Exploratory Systems Control Model Development (ESMD) loop delivered under Contract DCA100-76-C-0081. The operation of the original three loop system is described in the ESM User Manual of March 1977 (Document 66143-1). The current ESMD document will refer to the ESM User Manual and indicate any changes that may have resulted as a result of augmentations performed during ESMD. The ESM will also include a fifth loop to be supplied under the MSCDM Contract (DCA100-76-C-0083). The ESM provides a flexible tool for simulating and comparing a wide range of system control architectures and their related procedures and protocols. The ESM ~~has been~~ was designed to model the class of system control architectures that have the characteristics of decentralized operation, modularity, easy modification and upgrade capability, high reliability, high survivability and fail-soft operation.

1.2 BACKGROUND

The following is based on information in the Statement of Work for Contract DCA100-76-C-0081.

The Defense Communications System (DCS) is a global, multiple-user system composed of leased and Government-owned transmission media, relay stations, and switching centers deployed in support of the National Command Authorities and the services, including command and control, intelligence, and early warning, as well as administrative and logistical communications. In order to increase the reliability and availability of these DCS services,

it is essential to improve the responsiveness and robustness of the System Control (SYSCON) process as much as possible. This requirement demands a DCS SYSCON subsystem possessing such design features as modularity and "fail-soft" operation. Modularity implies a subsystem that is capable of being upgraded, modified, and reconfigured easiy, and "fail-soft" implies a subsystem that tolerates partial failures, yet is relatively immune to total collapse. To afford these capabilities, the future DCS SYSCON subsystem is expected to consist of many semi-autonomous, mutually supportive, geographically dispersed control centers.

During FY 75, under Contract DCA100-75-C-0054, Burroughs Corporation began development of an Exploratory System Control Model (ESM) which capitalized upon the inherent flexibility of multiple, interconnected data transmission rings and microprocessor-based host/ring interface nodes to provide an initial capability for experimental validation of various candidate SYSCON subsystem architectures characterized by distributed control and graceful degradation under stress. This capability to model apparently dissimilar architectures is a consequence of the universal physical connectivity provided by the ring structure coupled with flexible protocols that permit definition of different logical connectivities through selective routing of transmitted data.

The initial purpose of this contract is to complete planned development of the ESM as a beginning tool for the analysis and evaluation of alternative SYSCON subsystem architectures. In the broader context of the DCS SYSCON Program, the longer term joint purpose of this SOW effort and the separate but related "Modular System Control Architecture Study and Feasibility Development Model" is to provide DCEC with the necessary integrated means to

evaluate through hybrid simulation a variety of candidate SYSCON subsystem architectures and validate performance expectations for the architecture(s) thereby identified as being suitable for implementation. The prior ESM work, under contract DCA1-75-C-0054, supported initial development by the Burroughs Corporation. This follow-on contract will conclude development of the ESM by building upon the unique expertise demonstrated on Burroughs and the experience gained to date under the existing contract. The ESM will initially operate in stand-alone mode at the DCA Hybrid Simulation Facility (DCAHSF) as an amalgamation of Government-furnished hardware/software components organic to the DCAHSF and hardware/software/firmware supplied by the ESM contractor. Upon arrival of the SYSCON modular building blocks comprising the Modular Architecture Feasibility Development Model being procured under separate competitive contract, the ESM will serve as a core functional module by providing data interchange, data manipulation, and data storage services. Its versatile, microprocessor-based ring interface nodes will integrate other SYSCON functional modules (such as scanners, processors, measuring instruments, displays, and data storage devices) into a unified hybrid simulation model by mapping their disparate data formats and rates into the common formats and protocols of its data transmission rings. The technical and performance information obtained from the unified hybrid simulation model will ultimately be used in the preparation of performance specifications for the future DCS SYSCON subsystem.

1.3 SYSTEM ELEMENTS AND CONNECTIVITY

The ESM is a communications system used to interconnect devices (e.g., terminals, host processors, data communications lines) so that each device can interface with any other device for information transfer. To accomplish this, each ring is supplied with nodes that act as interfaces from ring to device and from ring to ring. The ring-to-ring nodes are called "gateway" nodes. Each node is the same physically as any other node except for a small amount of special separable hardware for each type of node. The major difference between nodes is in the software of the nodes.

The nodes provide all the necessary communications functions of queueing, parity checking, ACKing, NAKing, retransmitting, alternate routing, etc. The hosts and terminals need only supply the data processing functions and need not be concerned with the communications functions.

The original three loop ESM configuration is shown in Table 1-1 and Figure 1-1 of the ESM User Manual. The gateway node interchanges are via cables in the ESM configuration, but in principle can be via any communications medium such as telephone, microwave relay, optical transmission or satellite relay.

The terms "loop" and "ring" are interchangeable. Each loop is housed in a separate cabinet in this implementation, but this is not a necessity. A loop could, as easily, extend throughout a building or facility.

The ESMD loop 4 configuration is given in Table 1-1 and Figure 1-1.

Table 1-1. ESMD Loop Components (See Figure 1-1)

Ring 4: 5 Gateway Nodes (to ESM Ring 3, MSCDM Ring 5, AUTODIN II, TCCF, SDLC)

1	Host Node to Interface System Control Processor C
1	Burroughs B776 Host Processor C
1	CRT Node to Interface CRT Terminal (Node G)
1	Burroughs TD832 CRT Terminal
1	Host Node to Interface to GFE PDP 11/70 (Node H)
1	GFE PDP 11/70 System
1	B9344 terminal

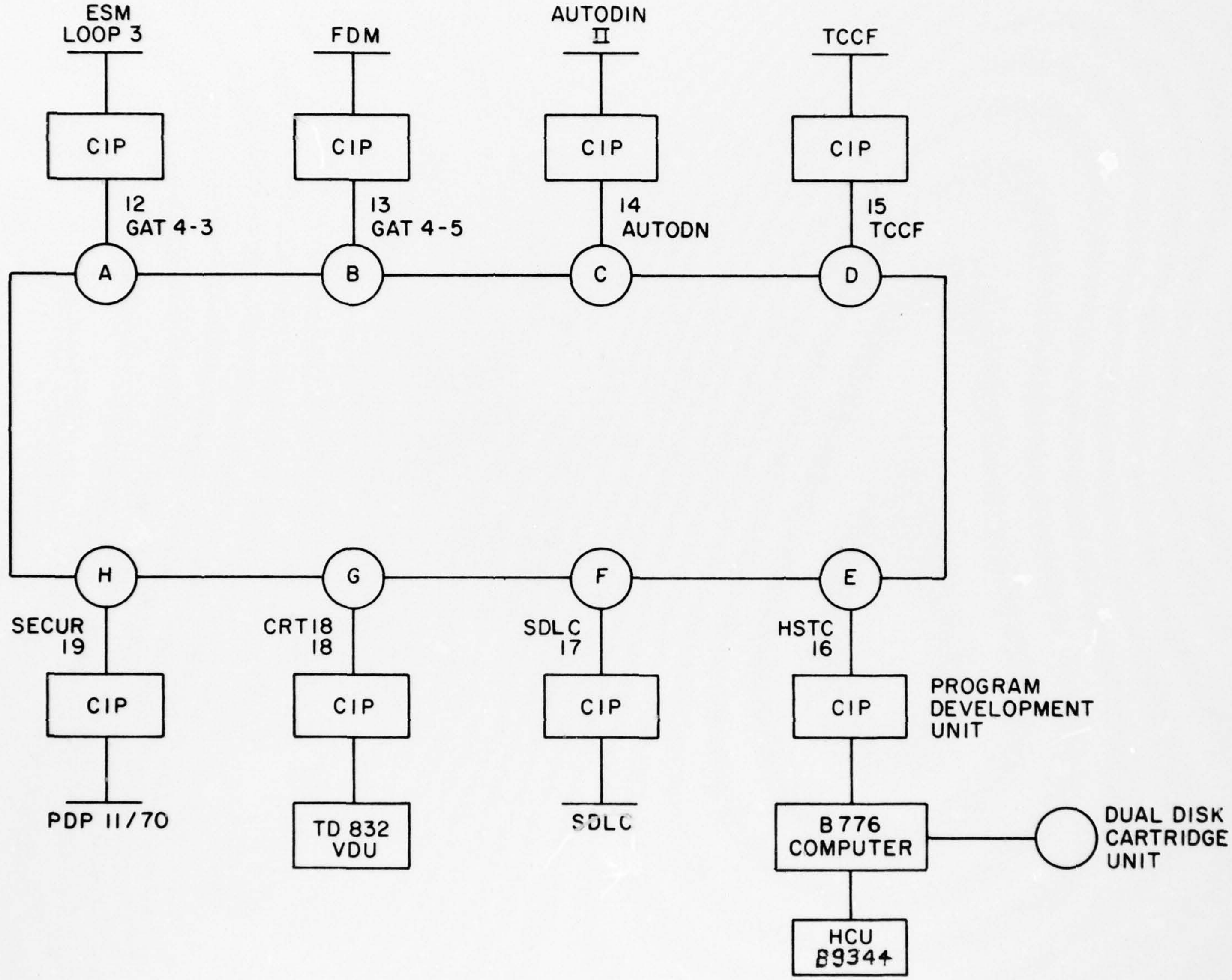


Figure 1-1. ESMD Loop 4

Loop 4 will connect to loop 3 to the node to interface future Host processor or terminal. This node (Node Designator 9) was connected to a modem which interfaced to a remote TI 745 terminal residing at Paoli. The hardware and software for this node will be modified to perform the gateway 3-4 function.

1.4 FEATURES OF THE ESM

Features of the original ESM three loop network are described in Section 1.4 of the ESM User Manual. The ESMD node is comprised of a Loop Interface Unit (LIU), a Control and Interface Processor (CIP) which is a Burroughs Data Set (BDS) microcomputer and an external interface. The LIU is completely redesigned with improved operation over the LIU of the original ESM. The BDS is a full microcomputer that operates from instructions derived from a higher level language (Extended ALGOL) and is particularly well suited to the processing of character strings. A comparison between the ESM and ESMD nodes is given below.

Line Discipline: The ESM node handles 25,000 bytes/second, the ESMD node handles 125,000 bytes/second. The ESMD LIU operates using the Burroughs Synchronous Data Link Control protocol (BDLC) including framing characters, bit orientation, zero insertion on write, zero deletion on read with a 16 bit cyclic redundancy check for packet validity.

Addressability: The ESM node can be set to only one address at a time, the ESMD node can be set to accept any combination of 256 addresses changeable on BDS command. Addresses can be set under BDS control for either destructive or non-destructive read and any address can be interpreted as a write token control character.

Recovery from LIU or Line Failure: Manual in the ESM, automatic through loop-back in the ESMD.

Buffering: Single packet in and out in the ESM, double packet in and out in the ESMD.

Memory: The ESM node has 4K x 12 control words and 12K x 8 data bytes. The ESMD has 32K x 8 bytes of control and data memory.

Control and Interface Processor: The ESM processor is a B7* that uses a microcode assembler, the ESMD processor is a BDS that runs code from an ALGOL compiler.

Write Control: The ESM uses a microcomputer interpreted node addressed control token. The ESMD uses an LIU interpreted orbiting control token.

SECTION 2
PHYSICAL CONFIGURATION

The original ESM physical configuration description is given in Section 2 of the ESM User Manual. A difference is that the HOST Node in Cabinet #3 is modified to function as a gateway node connecting loop 3 with the ESMD loop 4.

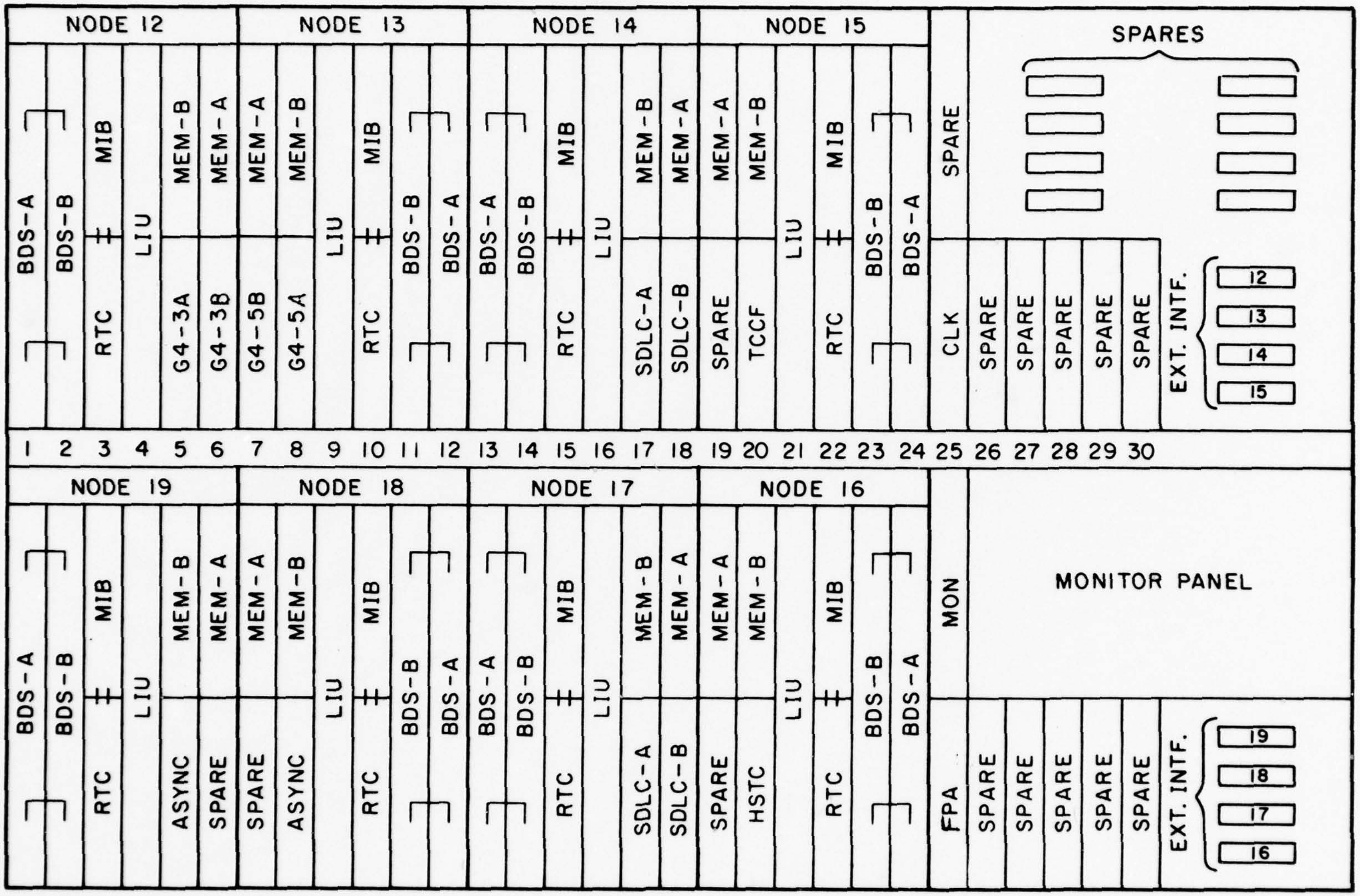
The ESMD loop 4 system will consist of the following major physical entities:

- B776 Host Processor System
- ESM Loop 4 consisting of 8 nodes
- CRT Terminal TD832
- B9344 Terminal

ESMD loop 4 consisting of eight nodes is contained in the B776 cabinet along with the B776. The loop and B776 have separate power supplies and control switches. The B776 cards are contained in four rows at the front of the cabinet, and the loop cards are contained in four rows at the back of the cabinet. The B776 cards are visible through a transparent door. The loop cards can only be viewed when the back cabinet panel is removed.

Four nodes are contained in the top backplane (top two rows of cards) and four nodes are contained in the bottom backplane as shown in Figure 2-1. Each node requires six slots - two for the BDS microcomputer, one for the memory interface board (MIB), one for the Loop Interface Unit (LIU), and two for memory and I/O interface cards. In addition to the unique nodal cards, there are two common loop cards - the monitor card and clock card. The debug monitor switch panel is contained on the upper right corner of the bottom backplane. Connectors for the nodes are contained on the bottom right corner of both backplanes.

Figure 2-1. ESMD PC Board Locations (Board Insertion Side)



NOTES:

1. TWO FRONT PLANE CONNECTOR BLOCKS INTERCONNECT EACH BDS-A&B PAIR AS INDICATED BY SYMBOL
2. TWO FLAT RIBBON CABLES INTERCONNECT EACH MIB/RTC PAIR AS INDICATED BY SYMBOL
3. EXTERNAL INTERFACE CONNECTORS ARE INDICATED BY SYMBOL SHOWING ASSOCIATED NODE NUMBER

Table 2-1 provides a listing of all of the ESMD PC boards, and cross references pertinent information relating to them.

Operator's controls for the ESMD are of three types: (1) Power, load, and clear for the B776, (2) Power, load, and clear for loop 4, and (3) Switch panel controls located within the cabinet used for diagnostics and maintenance. The specific location and use of these controls is detailed in Section 4.1 of this manual.

The B776 system configuration is given in Table 2-2. A detailed description of the hardware elements can be found in the B776 Documentation Package. B776 software documentation can be found in the B776 Stack Machine and RC User's Manuals. The TD832 CRT is described in the TD730/TD830 System Reference Manual (Burroughs Document 1093788). The TI 745 is described in the Silent 700 Electronic Data Terminals Model 745 Portable Data Terminal Operating Instructions (TIM Manual 984024-9701). The TOTAL data base management system used on the PDP-11 processors is described in the TOTAL PDP-11 Reference Manual (Cincom Manual P07-0001-1).

Table 2-1
ESMD PC BOARD IDENTIFICATION

Slot No.	Slot Ident.	Card Ident.	Part No.	Description
1	BDS-A	PROCESSOR-A	2574-0085M	Burroughs Microprocessor, Board A
2	BDS-B	PROCESSOR-B	2571-1771M	Burroughs Microprocessor, Board B
3	MIB	MIB	MIB	Memory Interface
3	RTC	RTC	RTC	Real Time Clock
4	LIU	LIU	LIU	Loop Interface Unit
5	MEM-B	ADO MEM	ADO MEM	Board B Memory (16K)
5	G4-3A	G4-3A	G4-3A	Board A Interface to ESM, Gateway 4-3
5	SECU	ASYNC	ASYNC	Interface to Security PDP 11/70
6	MEM-A	ADO MEM	ADO MEM	Board A Memory (16K)
6	G4-3B	G4-3B	G4-3B	Board A Interface to ESM, Gateway 4-3
7	MEM-A	ADO MEM	ADO MEM	Board A Memory (16K)
7	G4-5B	G4-5B	G4-5B	Board B Interface to FDM Gateway 4-5
8	MEM-B	ADO MEM	ADO MEM	Board B Memory (16K)
8	G4-5A	G4-5A	G4-5A	Board A Interface to FDM Gateway 4-5
8	CRT18	ASYNC	ASYNC	Asynchronous Interface to CRT 18 (Burroughs TD832)
9	LIU	LIU	LIU	Line Interface Unit
10	MIB	MIB	MIB	Memory Interface
10	RTC	RTC	RTC	Real Time CLock
11	BDS-B	PROCESSOR-B	2571-1771M	Burroughs Microprocessor, Board B
12	BDS-A	PROCESOR-A	2574-0085M	Burroughs Microprocessor, Board A
13	BDS-A	PROCESSOR-A	2574-0085M	Burroughs Microprocessor, Board A
14	BDS-B	PROCESSOR-B	2571-1771M	Burroughs Microprocessor, Board B
15	MIB	MIB	MIB	Memory Interface
15	RTC	RTC	RTC	Real Time CLock
16	LIU	LIU	LIU	Line Interface Unit
17	MEM-B	ADO MEM	ADO MEM	Board B Memory (16K)
17	AUT-A	SDLC-A	SDLC-A	Board A Interface To AUTODIN
17	SDLC-A	SDLC-A	SDLC-A	Board A Interface to SDLC
18	MEM-A	ADO MEM	ADO MEM	Board A Memory (16K)
18	AUT-B	SDLC-B	SDLC-B	Board B Interface to AUTODIN
18	SDLC-B	SDLC-B	SDLC-B	Board B Interface to SDLC
19	MEM-A	ADO MEM	ADO MEM	Board A Memory (16K)
20	MEM-B	ADO MEM	ADO MEM	Board B Memory (16K)
20	TCCF	TCCF	TCCF	Synchronous Interface to TCCF
20	HSTC	HSTC	HSTC	Interface to HSTC (Burroughs B776)
21	LIU	LIU	LIU	Line Interface Unit
22	MIB	MIB	MIB	Memory Interface
22	RTC	RTC	RTC	Real Time Clock
23	BDS-B	PROCESSOR-B	2571-1771M	Burroughs Microprocessor, Board B
24	BDS-A	PROCESSOR-A	2574-0085M	Burroughs Microprocessor, Board A
25	CLK	CLK	CLK	Clock Generator
25	MON	MON	MON	Monitor
25	FPA	FPA	FPA	Front Panel Adapter

Notes: (1) Some PC boards are used more than once while others are unique to the backplane. Refer to the drawing showing PC board locations to define the quantities of each type of PC board.

(2) An"M" following a part number indicates a standard Burroughs part which has been modified for use in ESMD.

Table 2-2

B776 System Configuration

Qyt.	Style No.	Part No.	Description
1	B776	2606 2323	Central Processing Unit
1		2605 3660	Power Option
1		2604 3406	SPO Control
1	B480-1	2602 4844	Disk Drive Control
12	B6-8	2601 3425	8KB Memory Module - 96K byte total
1	B392-1	2603 6855	Mag Tape Cassette Control
1	A9490-25	2602 4612	Mag Tape Cassette Unit
1	B9480-12		Dual Disk Cartridge Drive - Total capacity 4.6 MBytes
6	B9985-3	2158 4925	Disk Cartridges
1	B9344		Console Printer Keyboard 10 CPS

SECTION 3
INSTALLATION

Installation of the ESM is concerned with installing the B776 system, the loop, the TD832 terminal, and the TI745 terminal, and interfacing them with each other, the loop 3 ESM cabinet, and the GFE PDP 11/70. A typical floor plan layout is shown in Figure 3-1. The system cables are listed in Table 3-1.

Table 3-1. ESMD System Cables

Description	Length (ft.)
ESM loop #4 to loop #3	15
B776 Host Processor to Node 16	4
GFE PDP 11/70 to Node 19	50
TD832 CRT to Node 18	15
B9344 to B776	15

All cables are equipped with connectors at each end. These connectors are compatible with mating connectors provided on the equipment. All cables are either flat ribbon or twisted pair and, except for the B776 cable which resides within a cabinet, will be routed under the floor.

Figure 3-2 shows the physical characteristics of the B776-loop 4 cabinet. The cabinet is mounted on casters, but is expected to remain relatively stationary. The cabinet should be oriented as shown on the floor plan (Figure 3-1) for ease of operation and maintenance. Maintenance of the loop requires removing the back panel of the cabinet. Maintenance of the B776 requires removal of the front left panel, opening the front door, and swinging out the B776 backplane. Maintenance access clearance of at least three feet should be provided on each side of the cabinet.

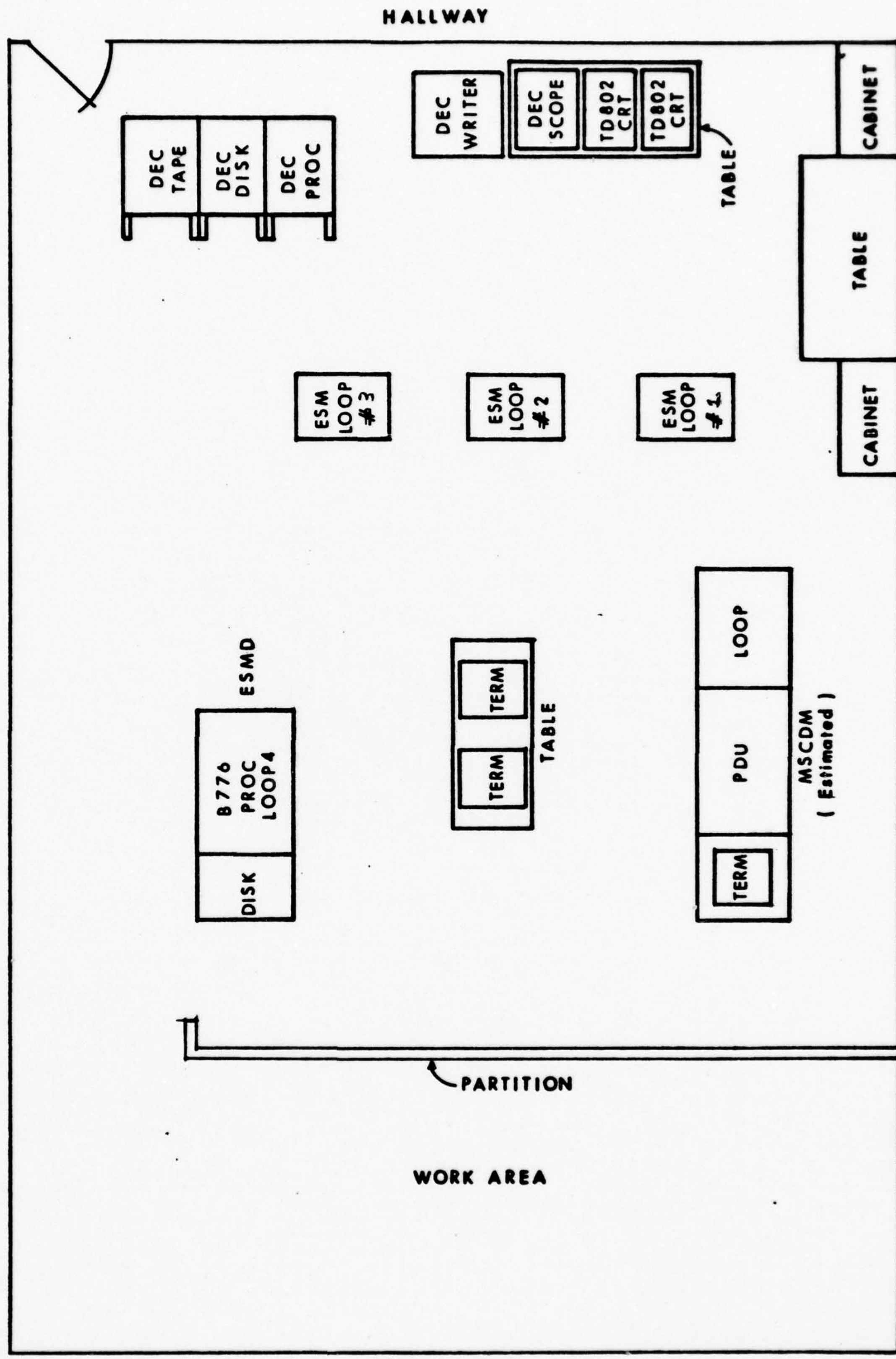


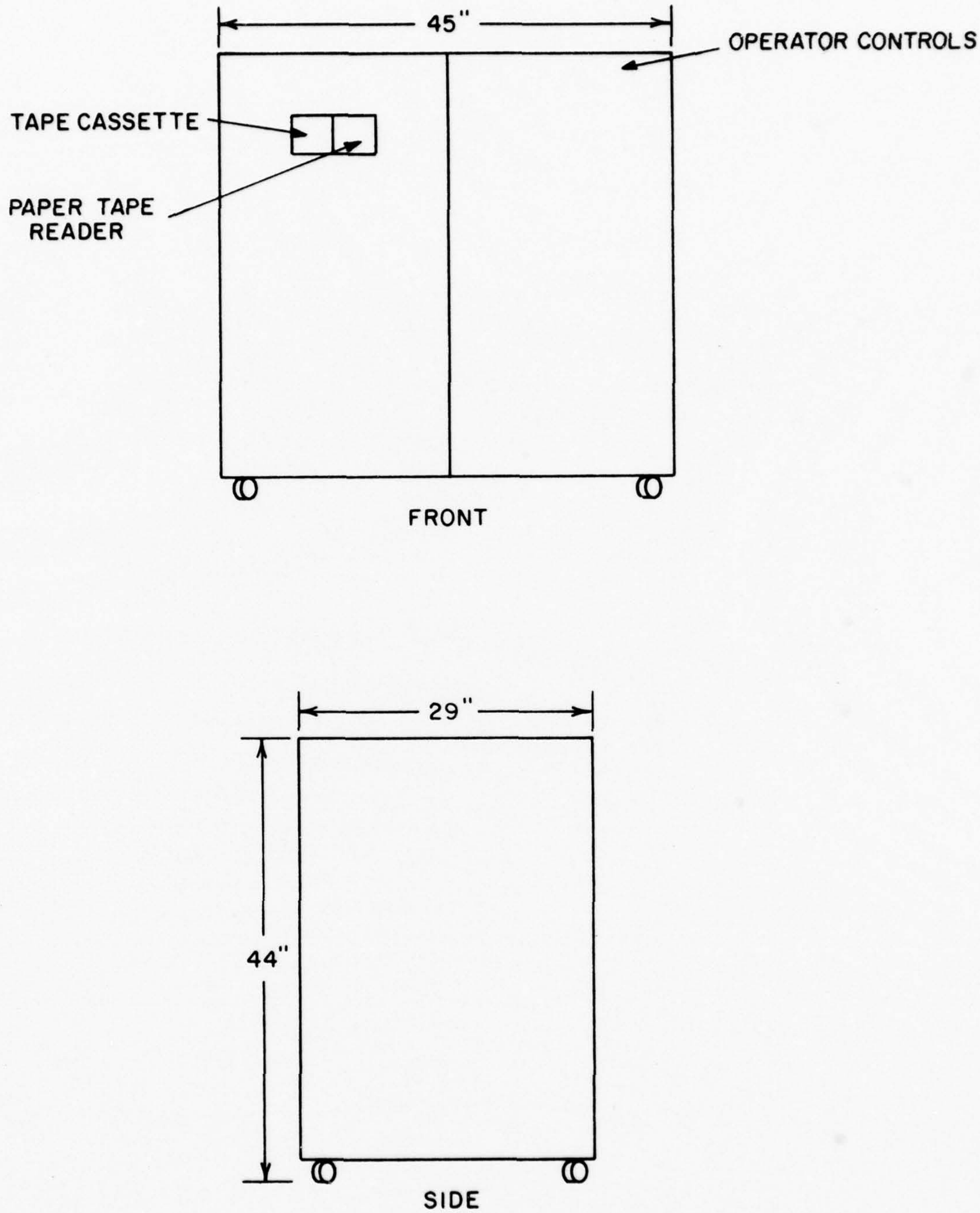
Figure 3-1

ROOM 1A22

FLOOR PLAN

EXPLORATORY SYSTEM CONTROL

MODEL ROOM



ALL DIMENSIONS ARE APPROXIMATE

Figure 3-2. B776-Loop 4 Physical Characteristics

All cables, including a-c power card, exit the cabinet via a cable opening in the bottom of the cabinet. All cabling and a-c power connections are to be under the false floor. Table 3-2 gives the a-c power requirements for ESMD.

Table 3-2

AC POWER REQUIREMENTS FOR ESMD

One Burroughs B776, Including Loop 4

60 , 120/208 V, Circuit Breaker 30 AMPS per LEG
3 Wire Plus Separate Ground
Receptacle - Hubbell 9450 (50 AMP)

One CRT, Burroughs TD832

Standard 3 prong plug, single phase, 60 , 115 V, 4 AMP

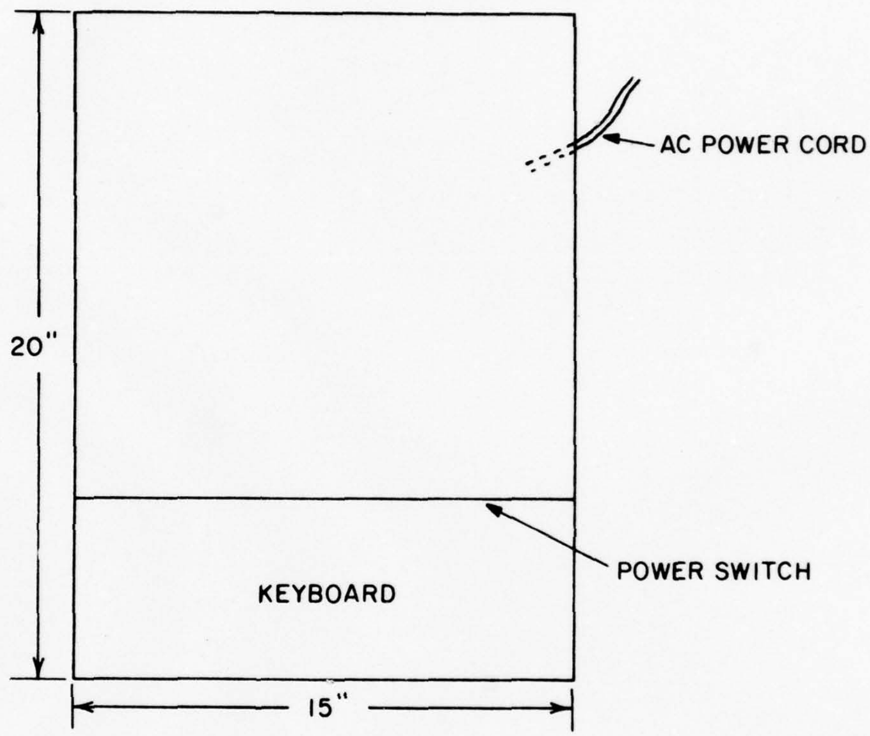
One Data Terminal, B9344

Receives power from B776 Cabinet

One Disk Memory

Receives power from B776 Cabinet

Figure 3-3 gives the TD832 physical characteristics. Figure 3-4 gives the TI745 physical characteristics. Figure 3-5 gives the B948-12 Disk Cartridge Drive physical characteristics.



ALL DIMENSIONS ARE APPROXIMATE

Figure 3-3. TD832 Physical Characteristics

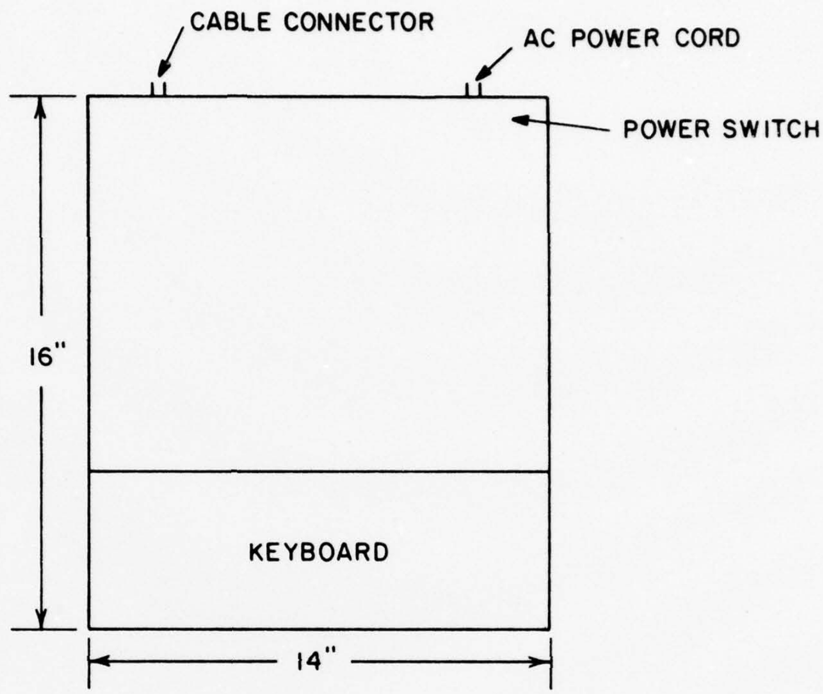


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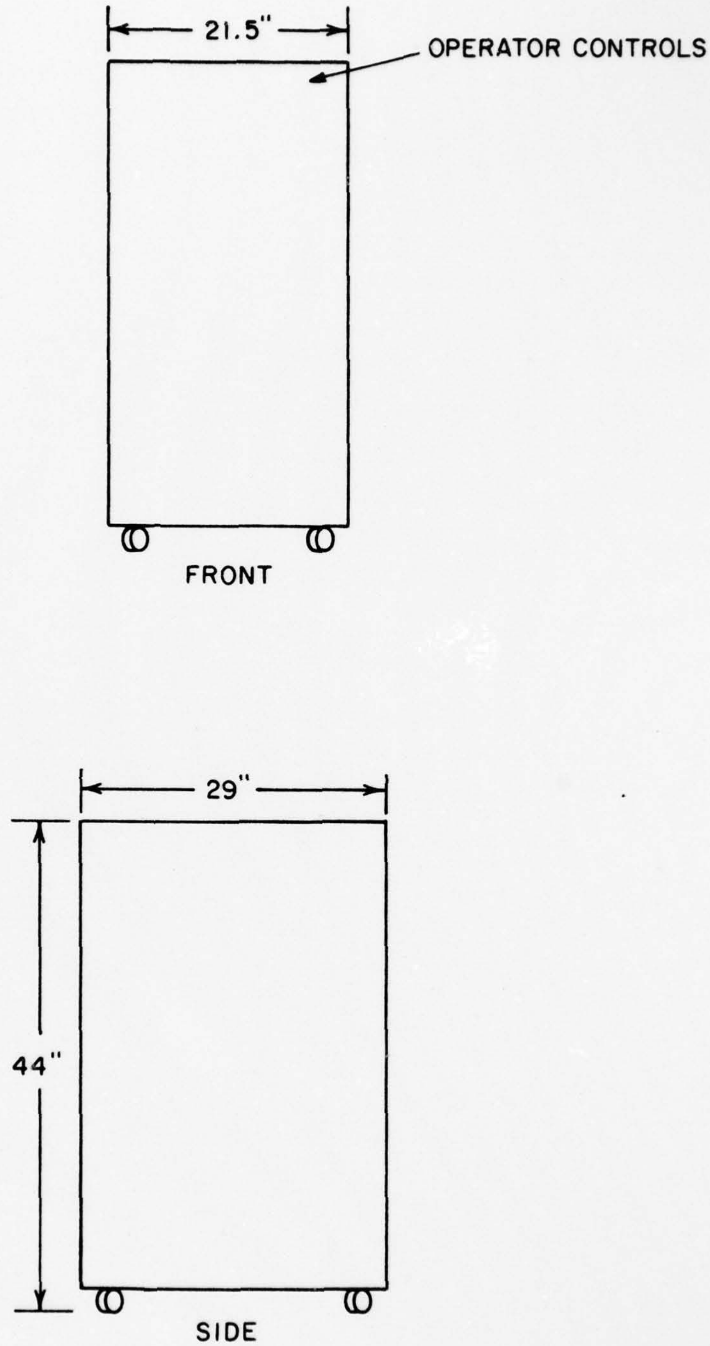
Figure 3-4. TI745 Physical Characteristics



ALL DIMENSIONS ARE APPROXIMATE

Figure 3-5. B9480-12 Disk Cartridge Drive Physical Characteristics

SECTION 4
OPERATING CONTROLS AND PROCEDURES

This section provides the information required for operation of the ESM. This information is provided in the following sub-sections:

4.1 Operator's Controls
4.2 System Tapes
4.3 System Startup
4.4 User Language
4.5 Maintenance and Diagnostics
4.6 Microcode Assembler

4.1 OPERATOR'S CONTROLS

Operator controls for the original ESM equipment are described in Section 4.1 of the ESM User Manual. ESMD controls are described in three categories:

1. B776 - Loop 4 Controls
2. Disk Controls
3. ESMD Monitor Controls

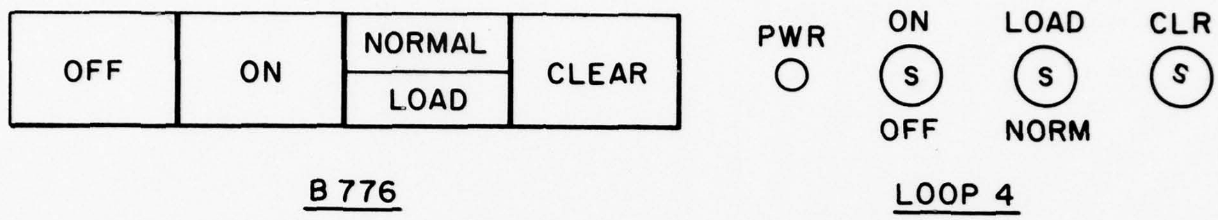
4.1.1 B776 - Loop 4 Controls

The B776-Loop 4 controls are located on the upper right hand corner of the front of the B776-Loop 4 cabinet as indicated in Figure 3-2. The switches are illustrated in Figure 4-1. The switch functions are listed below:

B776 Switches:

OFF - Turns power off

ON - Turns power on (lights up when on)



Legend

○ INDICATOR LIGHT

Ⓢ TOGGLE SWITCH - TWO POSITION

Ⓟ PUSHBUTTON SWITCH - MOMENTARY

Figure 4-1. B776-Loop 4 Control Panel

NORMAL/LOAD - When processor is in LOAD mode, switch glows red, when processor is in NORMAL mode, switch does not light up.

CLEAR - Clears processor (lift up plastic cover to operate switch).

Loop 4 Switches:

ON/OFF - Down position turns Loop 4 power OFF, Up position turns Loop 4 power ON, indicator light glows when power is ON.

LOAD/NORM - Up position for load mode for eight BDS processors, Down position for normal operation.

CLEAR - Up position stops all eight BDS processors, Down position runs all BDS processors from memory location zero

4.1.2 Disk Controls

The disk controls are located on the upper right hand corner of the front of the disk cabinet as indicated in Figure 3-5. The switches are indicated in Figure 4-2.

POWER ON - Turns power ON and OFF. Glows white when power is ON.

WRITE ENABLE for Drive 1 (Top) and Drive 2 (Bottom) - This indicator glows white when disk is write enabled. The light is off when disk is write protected. Write enable or protect is controlled by a white screw button on the bottom of the disk cartridge. For write enable the button is out, for write protect the button is pushed (screwed) in.

RUN/STOP for Drives 1 and 2 - This push button is used for running and stopping the disks. The indicator glows white when the disk is running. It glows red when the disk is stopped and the cartridge can be removed.

DOOR - Used for opening disk door. Glows white when power is ON.

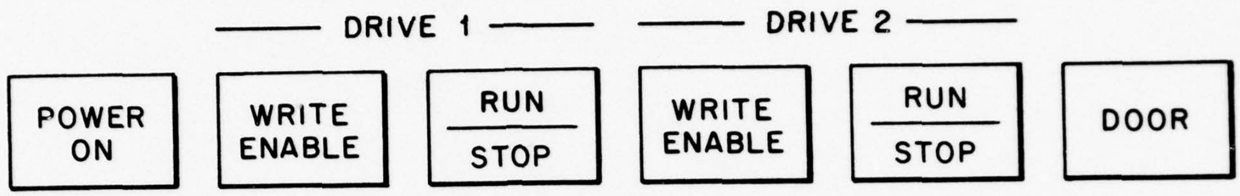


Figure 4-2. Disk Control Panel

4.1.3 ESMD Monitor Controls

The ESMD Debug Monitor resides within the ESMD cabinet on the top right hand corner of the lower loop backplane. The monitor is accessed by removing the back panel of the cabinet. It is only used for diagnostic and maintenance purposes and its operation is not required for normal loop 4 operation. It allows control of each of the eight BDS microprocessors. The BDS to be monitored is selected by attaching the monitor cable to the memory interface board (MIB) for the selected BDS. The monitor switch panel is illustrated in Figure 4-3. The controls and their functions are as follows:

Keypad - Hexidecimal keypad used for entering memory address and data.

4-Digit Display - Hexidecimal display used for displaying memory address and data.

A-SEL - Up position allows address information to be entered.

D-SEL - Up position allows data information to be entered.

FST - Up position puts BDS in a forced step or don't execute mode so that the memory address can be incremented or decremented without any instruction execution.

CMP - When compare switch is up, along with A-SEL and D-SEL, a memory location can be entered. With A-SEL and D-SEL down and CMP up, the BDS when run will stop at the memory location executed directly after the location entered.

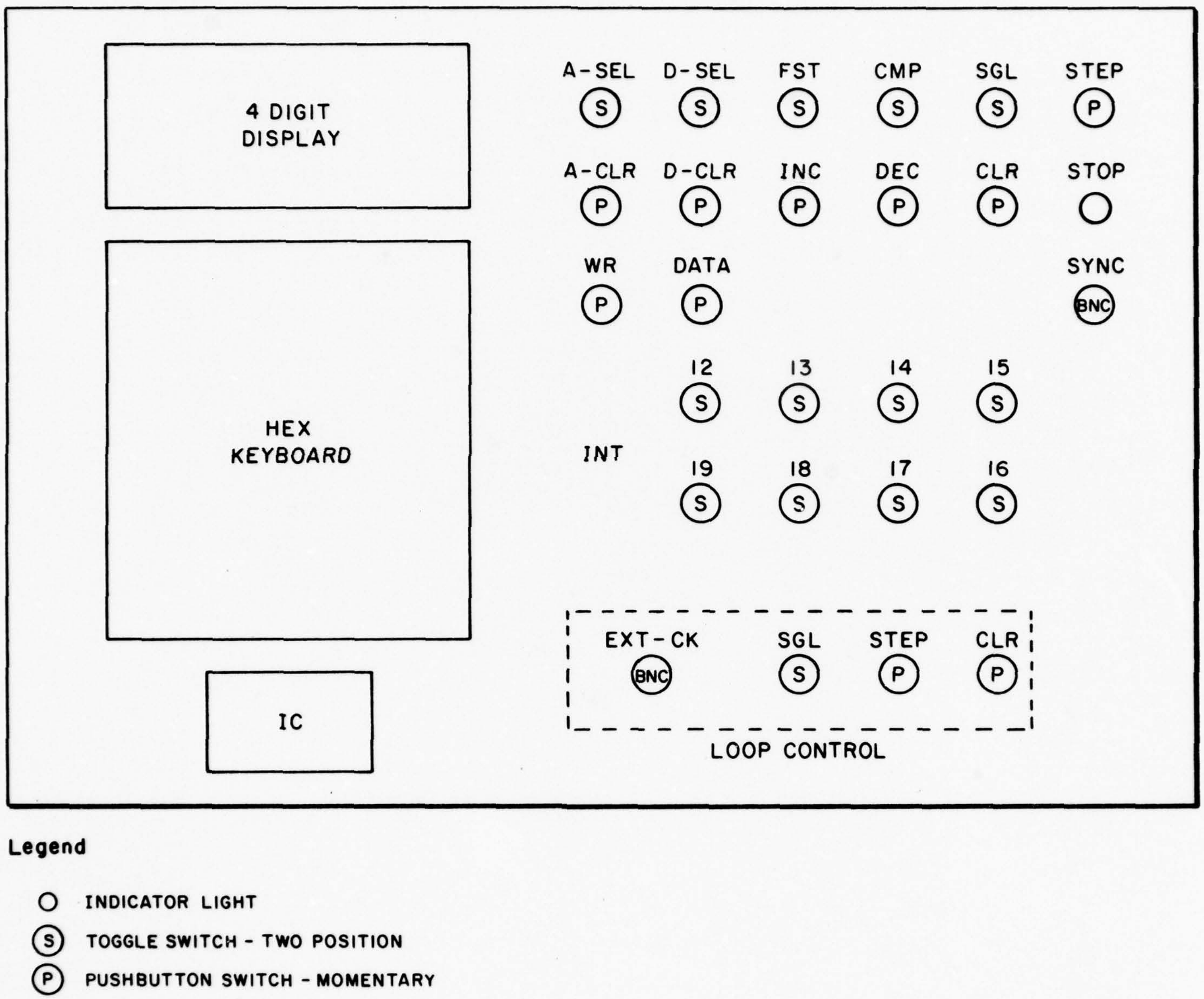


Figure 4-3. ESMD Monitor Switch Panel

SEL - Up position allows the BDS to be single-stepped, down position allows the BDS to run at its normal clock rate.

STEP - Used as a start execution button when BDS is in RUN mode, and used to single step when BDS is in STEP mode.

A-CLR - Clears the address register. Should be depressed before loading memory addresses (4 digits).

INC - Used to increment memory location when A-SEL is up.

DEC - Used to decrement memory location when A-SEL is up.

CLR - Used to clear memory location to zero. Its operation requires depressing both CLR and STEP simultaneoulsy when BDS is in STEP mode.

STOP - This indicator light glows red when BDS is stopped (not running).

WR - Used for writing data into memory. The procedure is to put processor into STEP mode, put A-SEL and D-SEL in up positions, press A-CLR, enter 4-digit memory location on keypad, press D-CLR, enter 2-digit data byte on keypad for that location, and then press WR. Note: sequential memory locations can be loaded with identical data by holding the WR button down while pressing the INC or DEC button.

DATA - Allows the data at the displayed memory location to be displayed (2-digits). Note: If the FST switch is up a D7 will be displayed since FST supplies the BDS with a NOOP instruction.

SYNC - Provides synching signal for test equipment connection.

INT12 - INT19 - Provides an interrupt to be generated (RQST7/) for the BDS's for nodes 12-19.

The following are for Loop control:

SGL - Allows the loop clock to be single-stepped.

STEP - Used with SEL. Each STEP button push advances the loop clock by 1/4 bit (i.e., 4 pushes per loop bit).

CLR - Resets/starts the loop clock.

EXT-CK - Used for external loop clock when top switch on clock board is in the down position.

4.2 ESM SYSTEM TAPES

The ESM system software for the two PDP11/40's and the B7* microprocessors is contained on four DEC TU10 Magtapes. The contents of these tapes are described below:

4.2.1 Tape #1 - User Language

This tape contains the User Language task (.TSK), FORTRAN source files (.FOR), object files (.OBJ), overlay description language file (.ODL), and display files. The files for the TOTAL distributed data base, card image capability (CRDIM) with virtual terminal drivers and loop file transfer utility (LPFT) are also on this tape.

4.2.2 Tape #2 - CIE Microcode

This tape contains the microcode source (.DAT) and object (.OBJ) files used for loading the eleven B7* CIE's. The microcode loader utility (ESMLDR) task, source and object file are also on this tape.

4.2.3 Tape #3 - MDMPL Assembler

This tape contains the task, source, object, and overlay description language files for the MDMPL assembler.

4.2.4 Tape #4 - Diagnostics

This tape contains the ESM Diagnostic Library.

4.2.5 Tape Transfer Operations

Files are moved from tape to disk using the FLX utility program. The following FLX tape to disk commands should be used.

<u>Moving Tasks</u>

FLX DKO:/CO = MT0: [20,20] USRLN5/BL:98.
where the value following BL: is the number of contiguous blocks required.

<u>Moving Microcode Object Files</u>

FLX DK0:/FB;256. = MT0: 1,4 LPCKO.OBJ

<u>Moving Microcode Source Files - In Card Image Mode for Compilation and Message Files</u>

FLX DK0:/FA:80. = MTO 1,4 PDP.DAT

Moving all other Files

FLX DK0:/RS = MT0: [20,20] P0000.FOR/DO

To Obtain a Tape File Directory Listing

FLX CL0: = MT0 [*,*] *.*/LI

Tape file directory listings are given in Appendix A.

4.2.6 B776-BDS Software

System software for the B776 and BDS processors are contained on the B776 disk.

4.3 SYSTEM START-UP

The following procedures are used for starting up the ESM.

4.3.1 Startup - Processor B (ND5) and B7* Loading (Loops 1-3)

4.3.1.1 Power up PDP11 Host B, ESM cabinets 1-3, and TD802 CRT's.

4.3.1.2 Bootstrap PDP11 B

(Steps 4.3.1.3 - 4.3.1.9 are performed on the VT52 DECScope)

4.3.1.3 Enter TIM

4.3.1.4 SET /UIC = [1,20]

4.3.1.5 RUN [20,20] ESMLDR
answer YES for normal load

4.3.1.6 Load 11 B7* microprocessors. For loading, the right-most switch on top row (LD/EN switch) is placed in Up position. The node to be loaded should have its LOAD switch in the second row in the Up position. Press M-CLR (Master Clear) button. Press Carriage Return key on DECScope to initiate loading each node. Make sure that the file name and node switch selected agree as given in Table 4-1. After loading, press second row LOAD switch down and then upper row LD/EN switch down and then depress M-CLR. Repeat the above procedure for each of the 11 nodes. When all nodes are loaded the RESET switch in each loop is switched up and then back down, and the M-CLR button in each loop is depressed to initialize the system.

Table 4-1. B7* Load Switches and Object File Names

LOAD SW	FILE NAME	LOOP #
HOST	HST1.OBJ	1
G1-2	GAT2.OBJ	1
G1-3	GAT3.OBJ	1
CRT	CRT4.OBJ	2
HOST	HST5.OBJ	2
G2-1	GAT6.OBJ	2
G2-3	GAT7.OBJ	2
CRT	CRT8.OBJ	3
HOST	HST9.OBJ	3
G3-2	GAT10.OBJ	3
G3-1	GAT11.OBJ	3

4.3.1.7 SET/UIC = [20,20]

4.3.1.8 @STESM (wait for display of "@ EOF ", before proceeding)

4.3.1.9 RUN CRDIM

4.3.1.10 ESM CRT4 will act as a terminal to the Host B Operating System. Special ESM control characters include # (paging feature for displays), CONZ (for control Z - utility exit), and squiggle (for carriage return used in EDI).

4.3.1.11 Enter RUN USRLNG on ESM CRT4.

4.3.1.12 Use the User Language as described in Section 4.4. Characters are entered on the CRT when it is in the LOCAL or FORMS mode. In LOCAL mode characters are transmitted from the upper-left-hand corner of the screen to the cursor location. A maximum of three lines of data can be transmitted at once as a packet. Characters are transmitted by depressing the XMT key on the upper-right-hand corner of the keyboard. The terminal will normally go into receive mode within 2 seconds after the transmit key has been depressed. If this fails to occur, reenter LOCAL mode and then redepress the XMT key. If a message is to be received and the CRT is in LOCAL mode, the terminal will beep and the ENQ light will be ON until the operator presses the RCV key. The audible beeping can be disabled on the TD802's be turning the associated volume control to the extreme right.

The STESM MCR command file is used to load a permanent copy of the system status file which corresponds to the nodal software loaded. In this manner changes to the system (e.g., nodal LID/FAD tables) during the course of the day will not be permanent. This command file should also be activated if the system is cleared after changes have been made to the system status file (INFO.DAT) (via Mode 3 of the Host B User Language). Indirect command files such as STESM must be initiated on local DEC terminals rather than ESM terminals.

To restart a terminal-host dialogue, enter "DS" on the ESM terminal.

To attach a terminal to some node in the system enter "ATTACHXX" where XX is the node designator of the destination (e.g., 05 for HSTB).

To abort USRLNG enter "ABORT" on the ESM terminal.

To abort CRDIM enter control C followed by "ABO" on the DECScope.

4.3.2 Startup - Processor A (ND 1)

4.3.2.1 Mount Disk Pack for RSX11M V3

4.3.2.2 Bootstrap PDP11A

4.3.2.3 Enter time when prompted on DECWRITER

4.3.2.4 On DECScope enter (steps 4.3.2.4 - 4.3.2.6)
HEL
enter PAULISH for account
enter ESM for password

4.3.2.5 @ESM - which sets up partitions and virtual drivers for ESM.

4.3.2.6 RUN CRDIM

4.3.2.7 ESM CRT8 will act as a terminal to the Host A Operating System.

4.3.2.8 Enter RUN USRLNG on ESM CRT8

4.3.2.9 Use the User Language as described in Sections 4.4 and 4.3.1.12.

4.3.3 Startup - Processor C (ND 16) and BDS Loading (Loop 4)

4.3.3.1 Turn B9344 terminal ON.

4.3.3.2 Turn TD832 ON

Enter CTRL SHIFT Y to get all upper case letters displayed. (Upper and lower case can be obtained by entering CTRL SHIFT T).

4.3.3.3 Turn loop power ON

4.3.3.4 Turn B776 power ON

4.3.3.5 Turn disk power ON

4.3.3.6 Drive 2 RUN ON

4.3.3.7 Drive 1 RUN ON

4.3.3.8 B776 Load SW ON

4.3.3.9 Press B776 Clear

4.3.3.10 Feed loader to paper tape into bottom slot of paper tape reader. (holes to the right)

4.3.3.11 Load SW OFF

4.3.3.12 Press Clear

4.3.3.13 On B9344 enter

?RUN SUN-RISE; DATA

enter TIME, DAY, DATE, NEXT as appropriate

?END

4.3.3.14 Put Loop 4 clear switch then the Loop 4 load switch in up position

4.3.3.15 Put Loop 4 Clear switch in down position

4.3.3.16 On B9344 enter

?RUN ESMLDR; DATA

answer YES for normal load

enter ?END when loading is complete

4.3.3.17 CRT18 (TD832) will now act as a terminal to the B776 Operating System.

4.3.3.18 Enter ?RUN USRLNG; DATA on CRT18

4.3.3.19 Use the User Language as described in Section 4.4 and 4.3.1.12.

4.3.4 B776 Loop 4 Power Down

4.3.4.1 Stop switch for Disk Drive 2. Wait for red STOP light to come ON.

4.3.4.2 Stop switch for Disk Drive 1. Wait for red STOP light to come ON.

4.3.4.3 Disk Power switch OFF.

4.3.4.4 B776 Power Switch OFF.

4.3.4.5 Loop Power Switch OFF.

4.4 USER LANGUAGE

The following Host-CRT dialogue is given as an example of the ESM User Language illustrating the flow diagrams of Figures 4-4 through 4-8. For CRT's in LOCAL mode responses are typed on the first line of the CRT and the XMT key must be pressed for each CRT response. For CRT's in FORMS mode the response is typed within the protected area(s), and the HOME key is pressed and then the XMT key is pressed for each CRT response. The dialogue may be restarted at any time by entering DS at the CRT.

Mode 1 (CRT-to-CRT) of the User Language is the same on processors A(ND1), B(ND5), and C(ND16). Mode 2 (System Inquiry) is the same except that processors A and C display the permanent nodal parameters corresponding to the nodal software; processor B displays the current parameter values and records changes as they are made in Mode 3. Mode 3 (System Control), resides only on Processor B. Terminals attached to processors A and C must enter ATTACH05 in order to attach to processor B for Mode 3. Mode 4 on processors A and B implement the TOTAL distributed data base. Mode 4 on processor C provides a file access and editing capability.

HOST: THIS IS THE ESM - (EXPLORATORY SYSCON MODEL)
ENTER USER CODE PLEASE

CRT: Usercode (enter either OWEN or DAN)

HOST: ENTER PASSWORD PLEASE

CRT: Password (enter ESM)

HOST: YOU ARE NOW LOGGED IN - (TO LOG OUT, ENTER "DS")

1. CRT TO CRT
2. SYSTEM INQUIRY
3. SYSTEM CONTROL
4. FILE ACCESS

CRT: 1-4

4.4.1 Mode 1 CRT-to-CRT (See Figure 4-5)

HOST: ENTER DEST CRT NODE DESIGNATOR (ND) - 4 FOR LP#2, 8 FOR LP#3, 18 for LP#4, 25 FOR LP#5. FORMAT I2.

CRT: 04, 08, 18, 25

HOST: PLEASE TYPE IN MESSAGE AND TRANSMIT

CRT: The message. (Enter on first 3 lines of CRT)

HOST: PLEASE SELECT ONE MODE OF OPERATION

1. NEW MESSAGE TO SAME CRT
2. NEW MESSAGE TO ANOTHER CRT
3. LOG OUT
4. NEW MODE OF OPERATION

CRT: 1-4

Dialogue now repeats as shown in Figure 4-5. If 3 is chosen, or DS entered then

HOST: YOU ARE LOGGED OUT FROM ESM

(To restart dialogue transmit some character(s).)

4.4.2 Mode 2 System Inquiry (See Figure 4-6)

HOST: PLEASE SELECT TYPE OF SYSTEM INFORMATION

1. NETWORK DEVICE INFORMATION
2. LID/FAD CONVERSION TABLE (LID's 1-100)
3. LID/FAD CONVERSION TABLE (LID's 101-254)
4. WORKPAGE PARAMETERS OF NODE

*CRT: 1-4

HOST: (If 1) See Figure 4-9 for typical display.

HOST: (If 2-4) PLEASE ENTER NODE DESIGNATOR (ND).
IF ND IS NOT KNOWN, ENTER "NDI" FOR NETWORK DEVICE INFORMATION.

CRT: Node designator or "NDI".

HOST: Typical display is shown in Figures 4-9 through 4-12. FIgure 4-9 results from "NDI" or from response 1 at * above. FIgure 4-10 is shown for response 2 at * above; Figure 4-11 results from response 3 at *; Figure 4-12 results for response 4 at *.

To continue after display, transmit a character.

HOST: PLEASE SELECT ONE OF THE FOLLOWING:

1. NEW SYSTEM INQUIRY.
2. LOGOUT.
3. ANOTHER MODE OF OPERATION

CRT: 1-3

4.4.3 Mode 3, System Control (Processor B only, See Figure 4-7).

*HOST: PLEASE ENTER TYPE OF SYSTEM PARAMETERS TO BE CHANGED.

1. NETWORK DEVICE PARAMETERS
2. LID/FAD CONVERSION TABLE (LIDS 1-100)
3. LID/FAD CONVERSION TABLE (LIDS 101-254)
4. WORKPAGE PARAMETERS * NOT IMPLEMENTED IN CIE MEMORY*

CRT: 1-4

HOST: PLEASE ENTER NODE DESIGNATOR (ND)
IF ND IS NOT KNOWN, ENTER "NDI" (FORMAT I2)

CRT: Two digit node designator (01-28) or "NDI". (If "NDI" is given, a display similar to that of Figure 4-9 will be shown. Then transmitting a character returns to HOST above).

IF 1 at * was selected.

HOST: PLEASE SELECT PARAMETER TO BE CHANGED, FOLLOWED BY THE NEW VALUE. FORMAT (I1, I4)

1. FUNCTIONAL (LOOP READ) ADDRESS.
2. NO CHANGE.

CRT: 1-2
(Go to ** for next host entry.)

If 2 at * was selected.

HOST: PLEASE ENTER LID FOLLOWED BY NEW FAD (FORMAT I4, I4).
FOR TABLE DISPLAY ENTER "LID".

CRT: LID, FAD or "LID". (If "LID" is given, a display similar to that of Figure 4-10 will be shown. XMT returns to HOST above.)
(Go to ** for next host entry.)

If 3 at # was selected.

HOST: PLEASE ENTER LID FOLLOWED BY NEW FAD FORMAT (I4, I4)
FOR TABLE PAGE DISPLAY, ENTER "TAB".

CRT: LID, FAD or "TAB". (If "TAB" is given, a display similar to that of Figure 4-11 will be shown. XMT returns to HOST above.)
(Go to ** for next host entry.)

If 4 at * was selected

HOST: PLEASE ENTER ONE OF THE FOLLOWING FOLLOWED BY NEW VALUE (FORMAT I1, A7). FOR NODE WKPG DISPLAY, ENTER "NNWD".

1. ALTERNATE GATEWAY FUNCTIONAL ADDRESS.
2. ALTERNATE GATEWAY FUNCTIONAL ADDRESS.
3. MAXIMUM INPUT QUEUE SIZE (EXTERNAL).
4. MAXIMUM OUTPUT QUEUE SIZE (BITSTREAM).
5. MAXIMUM PACKET XMISSIONS BEFORE MESSAGE TERMINATION.
6. TIMEOUT FOR WRITE TOKEN REGENERATION.
7. TIMEOUT FOR PACKET RETRANSMISSION.
8. NUMBER OF NODES IN LOCAL LOOP.

CRT: 1-8 New Value or "NNWD". (If "NNWD" is given, a display similar to that of Figure 4-12 will be shown. XMT returns to HOST above.)

HOST: PLEASE SELECT ONE OF THE FOLLOWING:

1. NEW SYSTEM CHANGE OF SAME TYPE.
2. NEW SYSTEM CHANGE OF DIFFERENT TYPE.
3. LOGOUT.
4. ANOTHER MODE OF OPERATION.

CRT: 1-4

Note: System control changes can cause malfunction of the system if care is not exercised. Certain types of malfunctions may be simulated through suitable system control changes. An example is a suitable change in functional address of a node such that the node will no longer receive messages.

4.4.4 Mode 4, File Access (Processor C only, See Figure 4-7)

HOST: PLEASE SELECT FILE TO BE ACCESSED:
1. CIRCUIT FILE.
2. TRUNK FILE.

CRT: 1,2

HOST: THE KEY IS X BYTES.
DO YOU WISH TO MODIFY THIS FILE?
1. YES
2. NO

CRT: 1,2
If 1 is selected go to *.
If 2 is selected go to **.

**HOST: PLEASE ENTER ACCESS KEY

CRT: 4 or 6 byte KEY

HOST: (If key exists, displays heading and record.)
(If key does not exist, responds with THE RECORD DOES NOT EXIST
continues at ***)
If record exists,

CRT: XMT a character Go To ***.

* For record modification

@ HOST: PLEASE ENTER KEY OF RECORD TO BE MODIFIED.

CRT: 4 or 6 byte KEY

HOST: FOR THIS RECORD, PLEASE SELECT TYPE OF DESIRED CHANGE
1. UPDATE
2. DELETE

CRT: 1,2. If 2 go to @@
If 1, record to be updated.

@HOST: THE KEY IS X BYTES.
ENTER THE RECORD ACCORDING TO THE FORMAT. WHEN CHANGES ARE COMPLETE, PRESS "HOME" and "XMT"
format heading
format heading
the record in protected area

CRT: Edits record in protected area, HOME and XMT.
Go to @@.

If record does not exist,

HOST: THE RECORD DOES NOT EXIST.
DO YOU WISH TO ADD A RECORD TO THE FILE?
1. YES
2. NO

CRT: 1, 2. If 2 go to @@
If 1 record to be added, go to @ (blanks in protected area)

@@HOST: MODIFICATION COMPLETE.

***PLEASE SELECT ONE OF THE FOLLOWING:

1. NEW RECORD OF FILE
2. NEW FILE
3. NEW MODE OF OPERATION
4. LOGOUT.
5. SAME RECORD.

CRT: 1-5 (Dialogue repeats as shown in Figure 4-8)

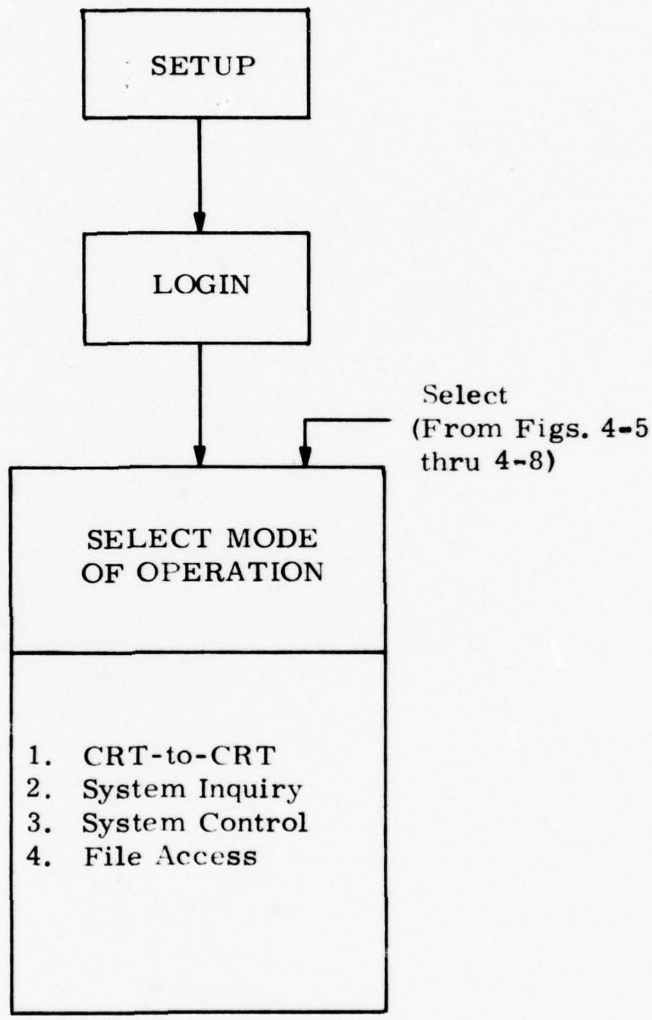


Figure 7-1. ESM User Language

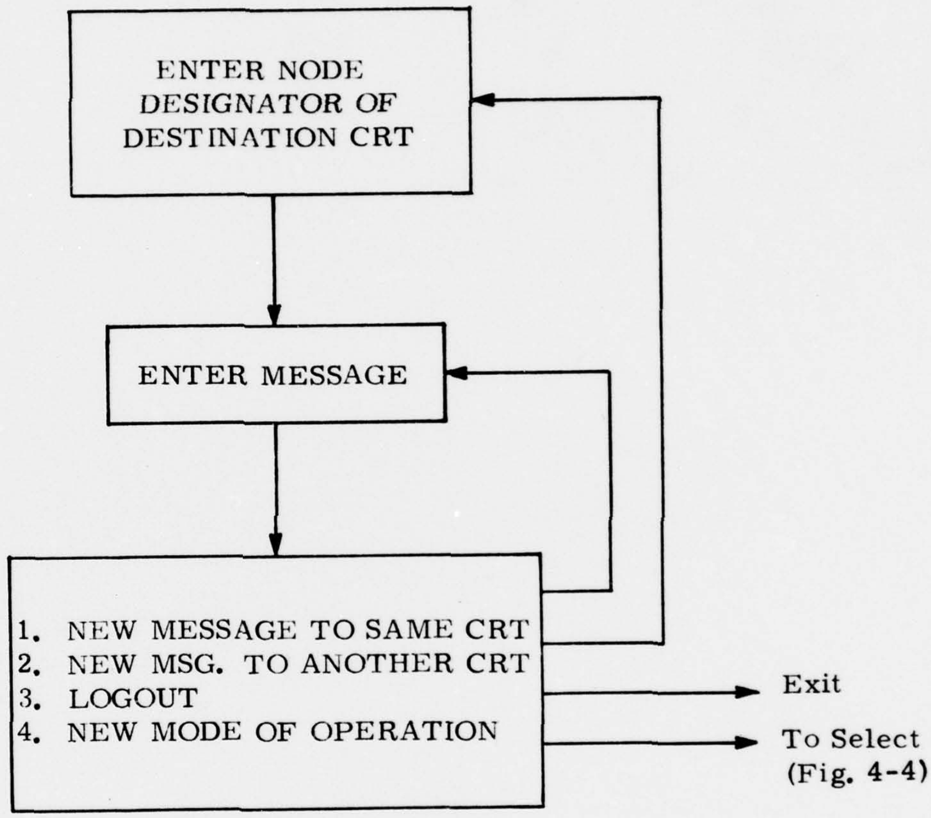


Figure 4-5. CRT-to-CRT Mode of Operation

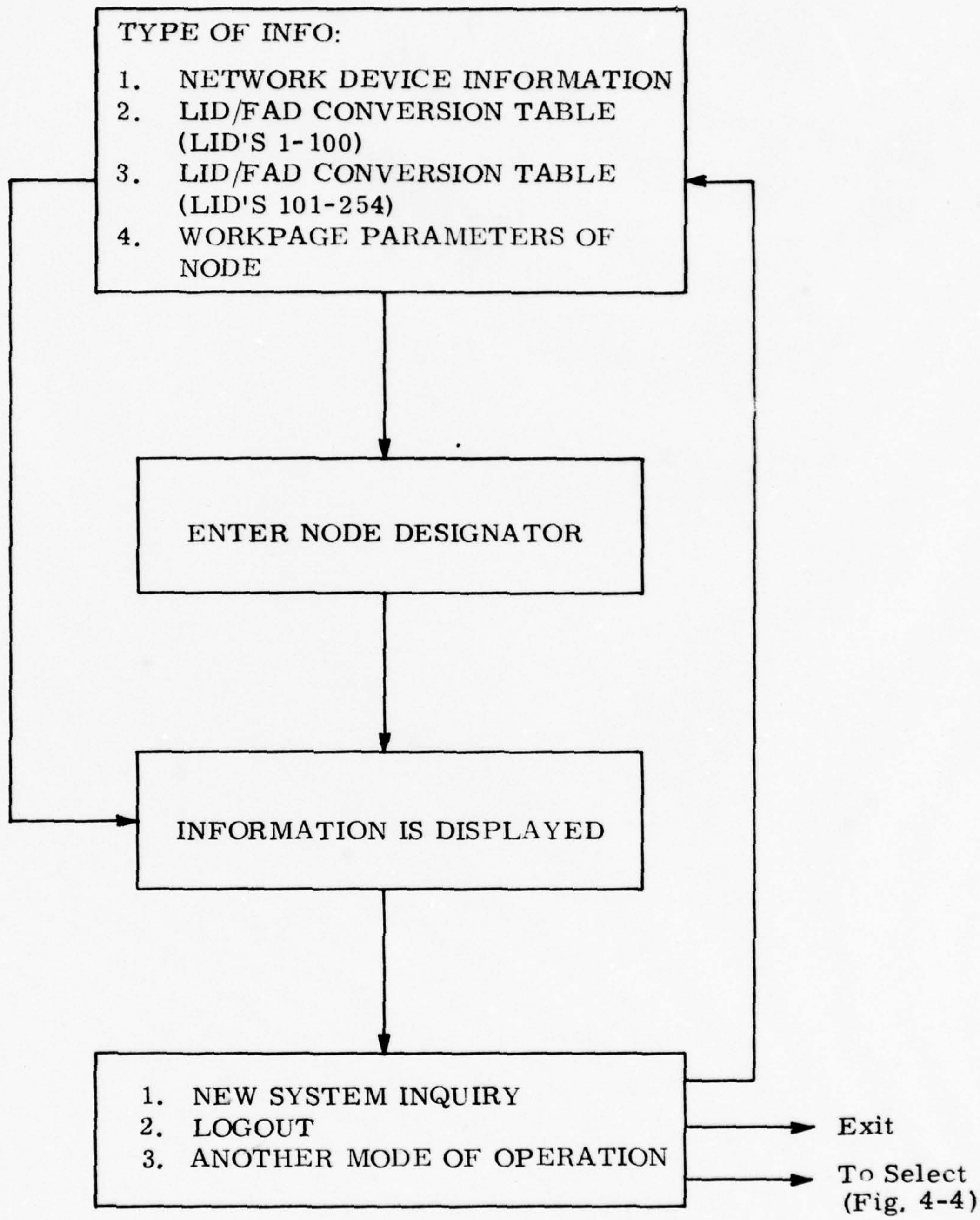


Figure 4-6. System Inquiry Mode of Operation

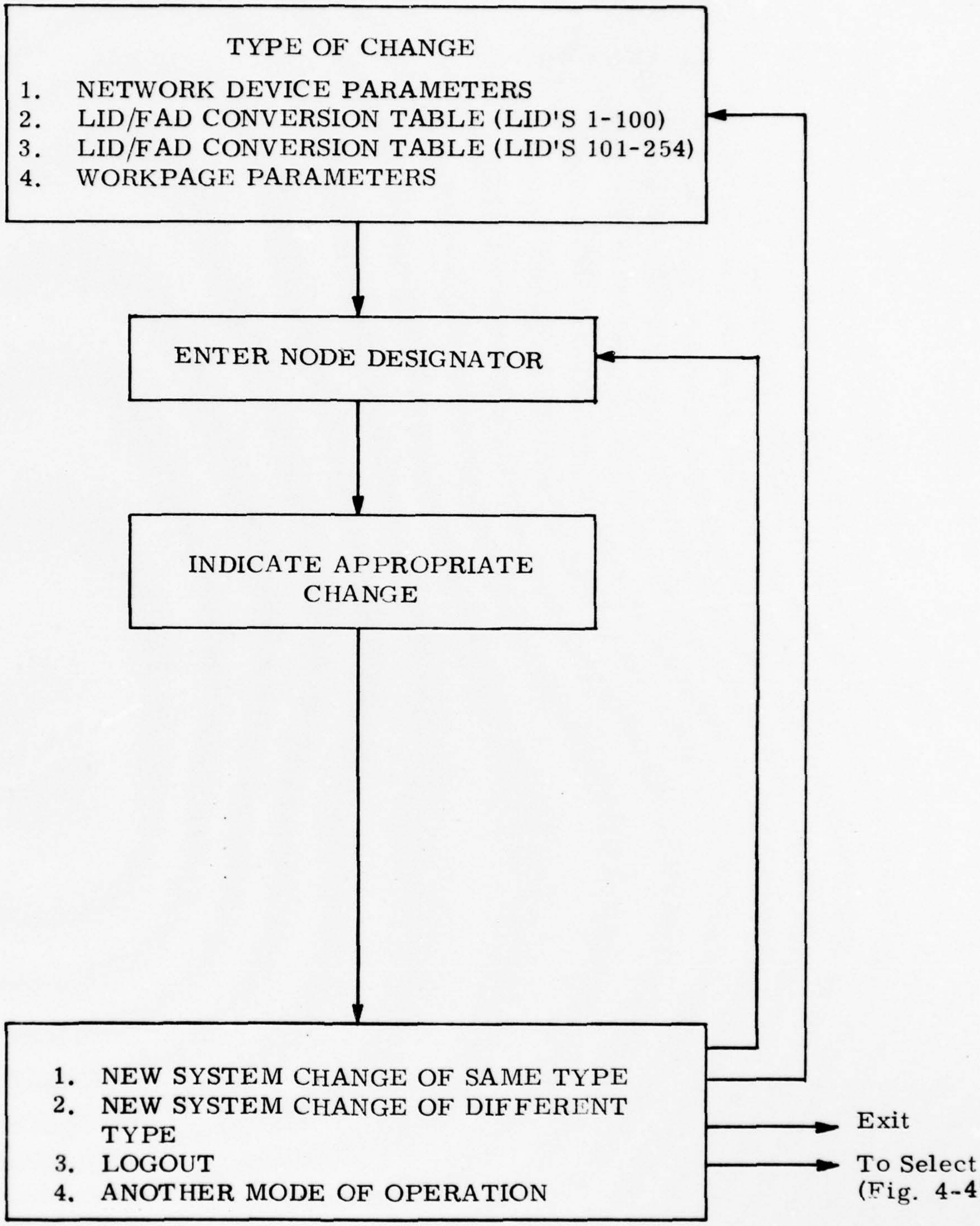


Figure 4-7. System Control Mode of Operation

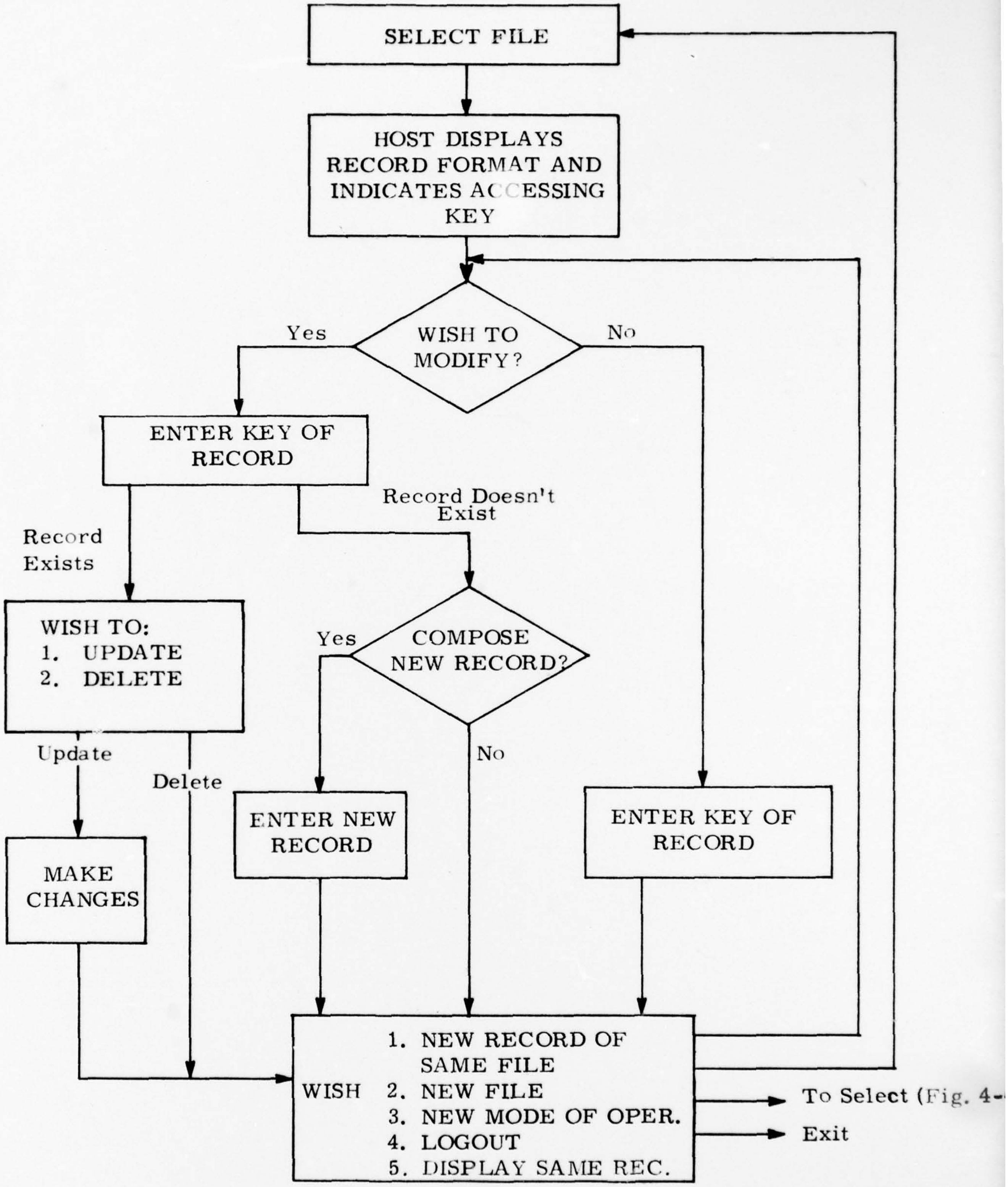


Figure 4-8. File Access Mode of Operation

NETWORK DEVICE INFORMATION

NT	ND	RDA	LP	NT	ND	RDA	LP	NT	ND	RDA	LP
HSTA	1	1	1	GAT3-1	11	1	3	CIS	21	1	5
GAT1-2	2	2	1	GAT4-3	12	3	4	VSQC	22	3	5
GAT1-3	3	3	1	GAT4-5	13	5	4	DSQC	23	6	5
CRT4	4	4	2	AUTODIN	14	1	4	HSTD	24	5	5
HSTB	5	2	2	TCCF	15	2	4	CRT25	25	7	5
GAT2-1	6	1	2	HSTC	16	4	4	BWBSA	26	8	5
GAT2-3	7	3	2	SDLC	17	6	4	FIAC	27	9	5
CRT8	8	3	3	CRT18	18	7	4	SDCA	28	2	5
GAT3-4	9	4	3	SECUR	19	8	4				
GAT3-2	10	2	3	SSCI	20	4	5				

Figure 4-9. Typical CRT Display for Network Device Information

LOOP 1 LID/FAD CONVERSION TABLE
FOR LIDS 1-100 (TWENTY FADS PER LINE)

LID1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	2	3	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3												
1	1	1	1	1															
2	2	2	2	2															
4	4	4	4	4															

Figure 4-10. Typical CRT Display for LID/FAD Conversion Table LIDS 1-100.

LOOP 2 LID/FAD CONVERSION TABLE
FOR LIDS 101-254 (TWENTY FADS PER LINE)

LID1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
5	5	5	5	5															
0																			
0																			
0																			
0																			
0																			
0																			
0																			

Figure 4-11. Typical CRT Display for LID/FAD Conversion Table LIDS 101-254.

NODE WORKPAGE PARAMETERS

CRT4 NODE HAS DESIGNATOR 4 In Loop #	2
ALTERNATE GATEWAY FUNCTIONAL ADDRESS	1,3
MAXIMUM INPUT QUEUE SIZE (TO EXTERNAL)	8
MAXIMUM OUTPUT QUEUE SIZE (TO BITSTREAM)	1
MAXIMUM PACKET XMISSIONS BEFORE MSG TERM	8
TIMEOUT FOR WRITE TOKEN REGENERATION	12
TIMEOUT FOR PACKET RETRNAMISSION	41
NUMBER OF NODES IN LOCAL LOOP	4

XMIT FOR NEXT INSTRUCTION.

Figure 4-12. Typical CRT Display for Node Workpage Parameters

4.4.5 Mode 4 File Access for Distributed Data Base (Processors A and B)

This mode is not of menu-selection type; instead it implements a command and control language based upon the TOTAL Data Management Language. Exit from mode 4 is done by entering "DS". Protected 78 byte command and data areas are used on the CRT screen. The first line is the protected area for the command. The next two lines are used for descriptive headers if applicable. The fourth line is used for the protected data area; i.e., the record data is displayed, modified, or added. The fifth line instructs the operator to press HOME and then XMT. An exception code of INVD is returned for commands containing an error. Descriptive material on the commands, the structure of the distributed data base, and exception codes can be found in Section 1 of the ESMD Final Report and the TOTAL manual.

4.4.5.1 Master Data-Set Commands

Master data-set commands are given in the form of a string 10+K bytes long starting at the left forms mark of the command area and presented without intervening spaces. The value K is the length of the key for the data-set involved (4 bytes for CKTK and 6 bytes for TNKK). The first six bytes are the commands TREADM, TWRITM, TADD-M, or TDEL-M. The next four bytes are the name of the data set (CKTK and TNKK). The key follows the data set name.

4.4.5.2 Variable-Entry Data-Set Commands

Variable-entry data-set commands are given in the form of a string 18+K bytes long starting at the left forms mark of the command area and presented without intervening spaces. The value K is the length of the master key to which the data-set is linked. The first six bytes are the commands TREADV, TWRITV, TDELVD, TADDVA and TADDVC. The next four bytes are the name of the data-set,

(CKTD, TNKD, XREF). The next eight bytes are the linkage-path in the form NAMELKXX where NAME is the name of the master data-set for that linkage-path. This is followed by the value of the key of the master data-set involved. The data area is used to display the record for the TREADV and TREADR commands and contains the new record for the TWRITV, TADDVA, and TADDVC commands.

4.4.5.3 TRDNXT Command

This function is used to determine the records that exist in a file in the form of a serial retrieval. A series of TRDNXT commands will retrieve records until the end of the data-set is reached. An "END." display will then be shown. The command has the form TRDNXTNAME where NAME is the data-set name.

4.5 MAINTENANCE AND DIAGNOSTICS

ESM maintenance and diagnostics are described in Section 4.5 of the ESM User Manual. The ESMD maintenance philosophy is similar to that of ESM; i.e., run diagnostic programs in order to isolate the bad card and then replace the bad card with a spare. The following paragraphs identify the various diagnostic programs and describe their application to the ESMD.

4.5.1 BDS Memory Test

SOURCE FILE: ESMD/MEM
OBJECT FILE: ESMD/OBJ-MEM

PURPOSE: To test the BDS memory

DESCRIPTION: This program writes and reads various patterns into the BDS memory starting at the location following the program itself. The patterns used are all zeroes, all ones, alternating ones and zeroes and random numbers. If the data read from a memory location doesn't match the data written to it, the program

uses the memory address to generate the column and row location of the bad memory chip. Otherwise, the program loops indefinitely repeating the tests.

OPERATING INSTRUCTIONS: Load the object code into the BDS memory. Initiate the programs. If no error is found, the display on panel board will have no specific pattern. If an error is found the display will shown a somewhat fixed address of 14x. To verify the finding of an error, place the BDS in single step mode. Press the single step button a number of times. The address displayed will be 149, 14A, 14B...etc. if an error is found. To find the location of the bad memory chip, read out the contents of location 152. The upper hexadecimal digit represents the column and the lower hexadecimal digit represents the row of bad chip on the memory board. The row and column addresses are zero origined. A one in the let most bit of the upper digit indicates an error on memory board A.

4.5.2 Address Comparison RAM Test.

SOURCE FILE: DIAG/ACM

OBJECT FILE: DIAG/OBJ-ACM

PURPOSE: To test the address comparison RAM of the LIU.

DESCRIPTION: This program writes and reads various patterns to the address comparison RAM. The patterns used are all zeros, all ones, alternating ones and zeros and random numbers. If the data read from a memory location doesn't match the data written to it, the program enters a tight loop. Otherwise the programs loops, repeating the tests indefinitely.

OPERATIONAL INSTRUCTIONS: Load a node with DIAG/OBJ-AMC and run the program. If the display shows an address pattern with a D in the second digit, an error has occurred.

4.5.3 BUFFER TEST

SOURCE FILE: DIAG/BUF

OBJECT FILE: DIAG/OBJ-BUF

PURPOSE: To test the input and output buffers in the LIU.

DESCRIPTION: This program initializes the buffers and then writes and reads various patterns from the LIU buffers. The patterns used are all ones, all zeros, alternating ones and zeros and random numbers. If the data read from a LIU buffer doesn't match the data written to it, the program stores an indicator of which buffer is in error. otherwise, the program loops, repeating the test indifinitely.

OPERATING INSTRUCTIONS: Load a node with DIAG/OBJ-BUF and initialize the program. Put the BDS in single step mode and step through the program. If the program is looping at addresses CF, B0, B1, B2 then an error has been found. Read location 7FFF to determine which buffer is being addressed.

4.5.4 Send - Receive Test

SOURCE FILES: DIAG/SEND
DIAG/RCV

OBJECT FILES: DIAG/OBJ-SEND
DIAG/OBJ-RCV

PURPOSE: To test the data transfer function of the LIU.

DESCRIPTION: DIAG/OBJ-RCV initializes the input buffers for its node and waits to receive an interrupt. When an interrupt is received, the program reads the status byte from the LIU to determine what action is to be taken. If the status byte indicates that data is available, the program reads the data into one of two memory areas depending upon which input buffer in the LIU is full. For other interrupts, the program goes into one of several loops to indicate the status bit that was set.

OPERATING INSTRUCTIONS: Load DIAG/OBJ-SEND and then load DIAG/OBJ-RCV. Turn an external INT switch on the sending node on and off. Check the memory starting at addres 400 for a sequence starting at 04 and ending at FF, followed by CC,11. To test both input buffers, place the receiving node in the step mode and turn the external INT switch on the sending node on and off twice. Check the memory starting at address 400 and address 500. Status byte 0 is stored in location 700 and status byte 1 is stored in location 701.

4.5.5 Write Token Detect Test

SOURCE FILES: SOURCE/WTDR
SOURCE/WTDS

OBJECT FILES: OBJ-WTDR
OBJ-WTDS

PURPOSE: To test the write token detect function of the LIU.

DESCRIPTION: These programs send and receive data and write tokens from each other. OBJ-WTDR initialize the input and output buffers of the LIU for the node in which it is loaded and then waits for an interrupt. OBJ-WTDS initializes the buffers for its node, sends out a write command and then waits for an interrupt.

When an interrupt is received , the programs read the status byte to determine the cause of the interrupt. If the status byte indicates that data is available, the program reads the data into one of two memory areas depending upon which input buffer in the LIU is full. If the write token detect bit is set in the status byte, then a flag is set in memory to record the occurrance. Other interrupt conditions result in the programs entering one of several tight loops indicating the condition.

OPERATING INSTRUCTION: Load one node with OBJ-WTDR and then load the other node with OBJ-WTDS. Examine location 600 to determine if a write token has been received. If the contents of 600 is FF no write token was detected. The memory areas for the input data start at 400 and 500. The data received by OBJ-WTDS should be a sequence starting with 05 and ending with FF, followed by CC,22.

4.5.6 Real time clock test

SOURCE FILE: ESMDIAG/RTC

OBJECT FILE: ESMDIAG/OBJRTC

PURPOSE: To the test the real time clock card

DESCRIPTION: This program waits for interrupts from the real time clock and increments a counter when one is received. It also reads the value of the clock when the interrupt occurs and stores it in memory. After a known interval, the program can be stopped and the counter checked to verify the accuracy of the clock. The number of interrupts is stored in location 30, and the clock value read at the time of interrupt (which should be zero) is stored starting at location 31.

4.5.7 CRT Test

SOURCE FILE: ESMDIAG/CRT

OBJECT FILE: ESMDIAG/OBJCRT

PURPOSE: To test the CRT interface

DESCRIPTION: This program reads in a message from the CRT and echoes it.

4.6 MICROCODE ASSEMBLER

Microcode for the BDS can be generated using the MGB Assembler (Microcode Generation on BDS). The assembler is invoked from the RC (Remote Card) text editor on the B776 processor. The sequence of commands for creating an MGB source file is as follows:

```
?RUN RC; DATA
OPEN filename MGB NEW
```

See the RC User's Manual for operation of RC. See the BDS Micro Instruction Definition Manual for BDS microinstructions. LABELs must be declared in a LABEL statement. Variables may be assigned hexidecimal values by preceding the value with "#". Comments can be put on a line by placing a "*" in column 1. Statements are terminated with ";*" and comments can be placed on the remainder of the line. The last line of the source file contains FINISH?. By convention, labels start in column 1, statements start in column 8 and terminators and comments start in column 35. Labels end with a colon. The instruction memory address (4 hex digits) and memory location (2 hex digits) are printed for program debugging using the ESMD monitor. Forward references are indicated by ** and are printed at the end of the listing. The RC command to create a BDS loadable object file is

```
    @ASSEMBLE   object file name
```

SECTION 5
THEORY OF OPERATION

The theory of operation of the ESM is described in the ESM User Manual. The ESMD system uses the same packet description (header functions) and methods of addressing by logical ID/functional address tables as the ESM. The nodal software is functionally the same for both systems except that ESMD uses a higher level language (extended ALGOL).

The ESMD hardware and loop data stream is quite different for ESM. A functional block diagram of a communication loop node is given in Figure 5-1. The Loop Interface Unit (LIU) is responsible for reading data addressed to the node and writing data on the loop. The Control and Interface Processor (CIP) is a microcomputer that provides an interface to the external device. The memory is used for program storage, routing tables, and intransit queue storage. The external interface provides a hardware connection to the external equipment connected to the loop.

The salient features of the ESMD node construction are shown in Figure 5-2. The LIU implements a BDLC loop data protocol, and it is composed (from bottom to top in the diagram) of a secondary data stream delay, clock loss detectors and logic for automatic loop-back; line interface and control logic for read and write logic including address recognition; double input and output buffers with buffer status registers; and the BDS interface and control. All of the LIU logic is in the form of TTL chips and MOS memory chips in DIP form mounted on a single multiwire card. The Burroughs BDS is in the form of two cards containing nine LSI chips and a number of other chips. The memory is contained on two half-sized cards each containing 16K bytes of memory. The BDS controls the LIU and the external interface and control.

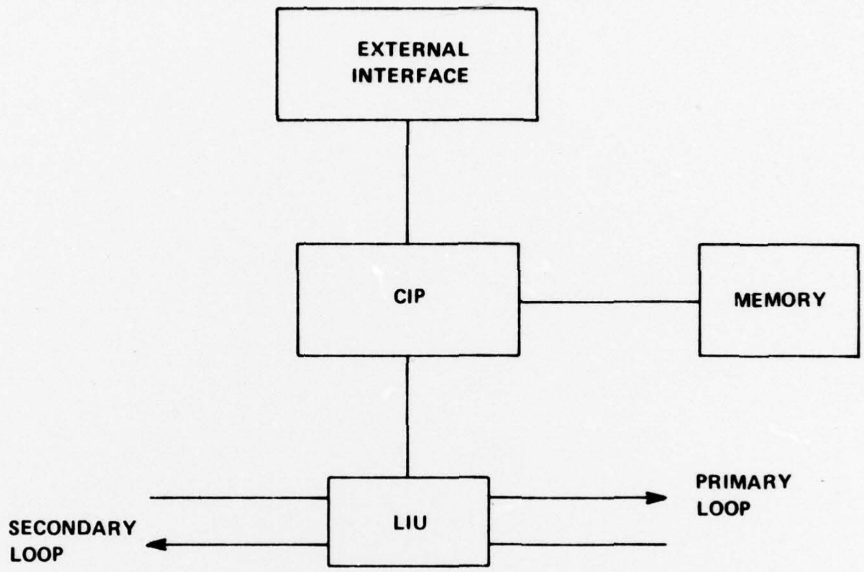


Figure 5-1. Communication Loop Node

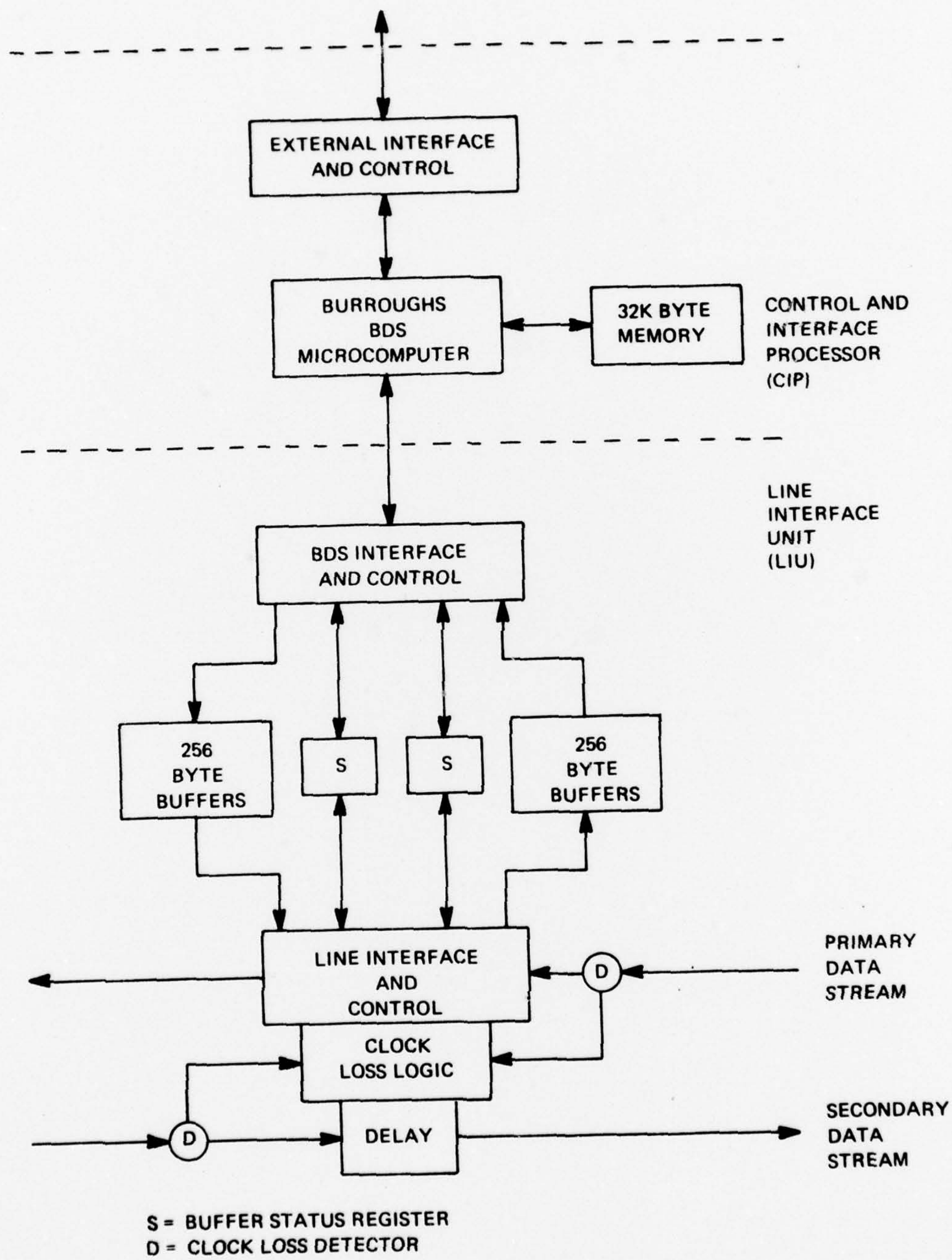


Figure 5-2. ESMD Node

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This publication is the User Manual for the Exploratory Systems Control Model Development (ESMD). It describes the system, each capability and how to use it. This manual was prepared by the Burroughs Corporation and is submitted in accordance with the requirements of contract DCA100-76-C-0081.

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